

# Possible Mechanisms of South East United States Drought

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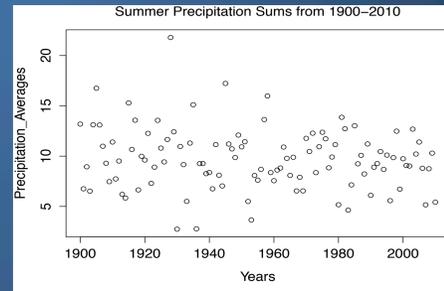


## Abstract

This study explores the believed causes of drought in the United States' South East region, particularly the Carolina's and the states of Florida and Georgia. Predominately this study looked at climatology factors which could influence and disrupt weather norms such as precipitation. Therefore North Atlantic Oscillation (NAO), and El-Niño Southern Oscillation (ENSO) indices, were analyzed with precipitation averages to determine if such a connection truly existed via correlation and covariance tests. Furthermore, a time analysis of Palmer's Drought Severity Index and NAO was conducted to visually analyze if a connection between negative phase NAO and drought existed. Statistical correlations revealed that correlation coefficients peaked at around 0.48 and went as low as -0.37. Covariance coefficients peaked at 0.85, and went as low as -0.47. The time analysis revealed that there is variability between NAO high or low years and drought, which would require more analysis to strengthen results.

## Data & Methodology

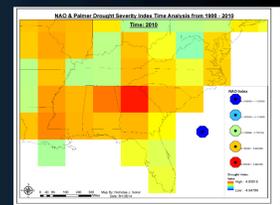
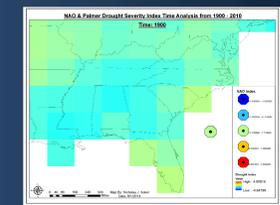
- All data analyzed covered a time period of 111 years, from 1900 to 2010.
- R statistics software was utilized to complete all correlations, as well as correlation maps that are shown in this study.
- ArcGIS was used for the time analysis of NAO, hurricane events and drought occurrence for the United States South East.
- Gridded precipitation data were gathered from the University of Delaware's monthly precipitation database, and organized via month and latitude and longitude for precise analysis.
- NAO and ENSO indices were taken from the KNMI Climate Explorer website, and edited for quality within excel.
- Palmer's Drought Severity Index data were gathered from NCAR UCAR's Climate Analysis Center.
- Hurricane trajectory data were gathered from NOAA's severe weather database.



## Results (continued)

### NAO-PDSI Drought Time Analysis (See Computer)

- Displays an interactive and visual analysis of NAO and drought.
- Results were gathered via direct observation, and looked for years of high drought severity, and low NAO.
- Observation shows that a connection exists between the two phenomena, but the significance is too minor to rely on fully.



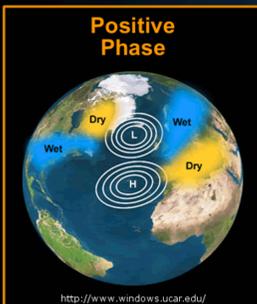
## Introduction

### Why Study Drought in the American South East?

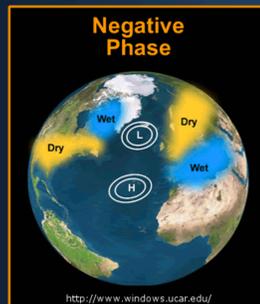
- The American South East is a critical region for U.S agriculture. Crops such as Oranges, Peaches, Cranberries, Tobacco and Cotton are predominately grown in this region. Furthermore, it has been estimated to be one of the fastest growing regions in the country according to recent census population projections, making it further vulnerable to urbanization which could lead to water shortages and agricultural strain.
- The purpose of this study is to investigate connections between global atmospheric patterns and regional drought in order to promote preparation and mitigate damage from drought.

### What is North Atlantic Oscillation (NAO)?

#### Positive NAO Influence

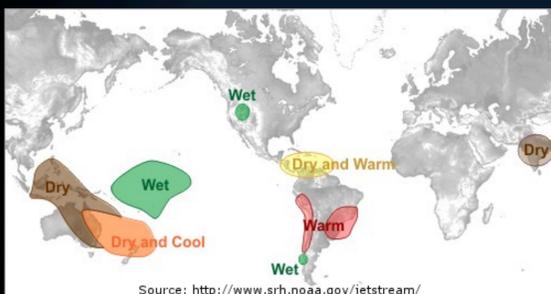


#### Negative NAO Influence



- Positive NAO strengthens the Azores High, promoting rainfall along the eastern seaboard of the USA. During the negative phase drier than normal conditions are experienced.

### What is El-Niño Southern Oscillation (ENSO)?



- El-Niño in the summer influences the jet stream to reduce vertical wind shear, therefore reducing cyclogenesis in the Atlantic.

## Results

### June, July, & August NAO-Precipitation & ENSO-Precipitation Correlation and Covariance Maps

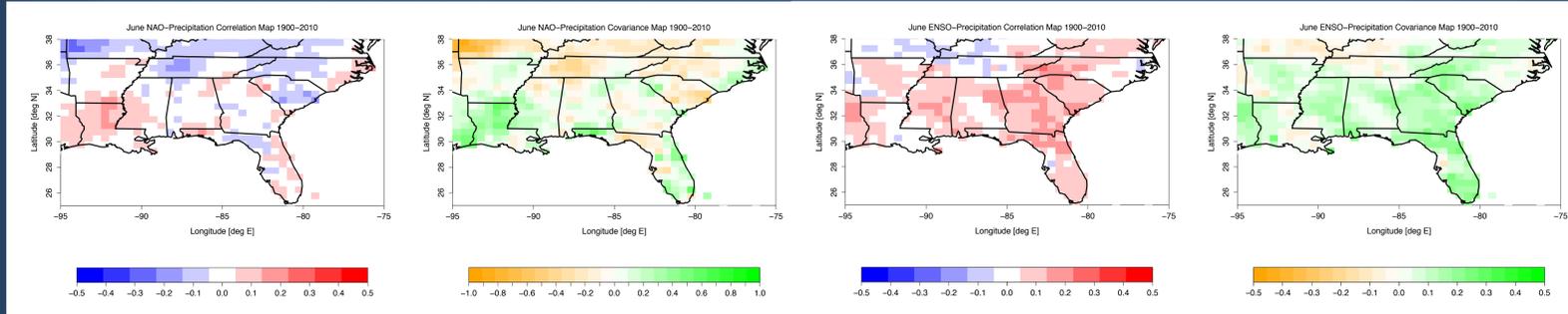


Figure 1. June tests revealed that neither El-Niño nor NAO dominate influence over precipitation rates in the south east for the month, Neither coefficient of covariance nor correlation reached a value stronger than -0.5 or 0.5.

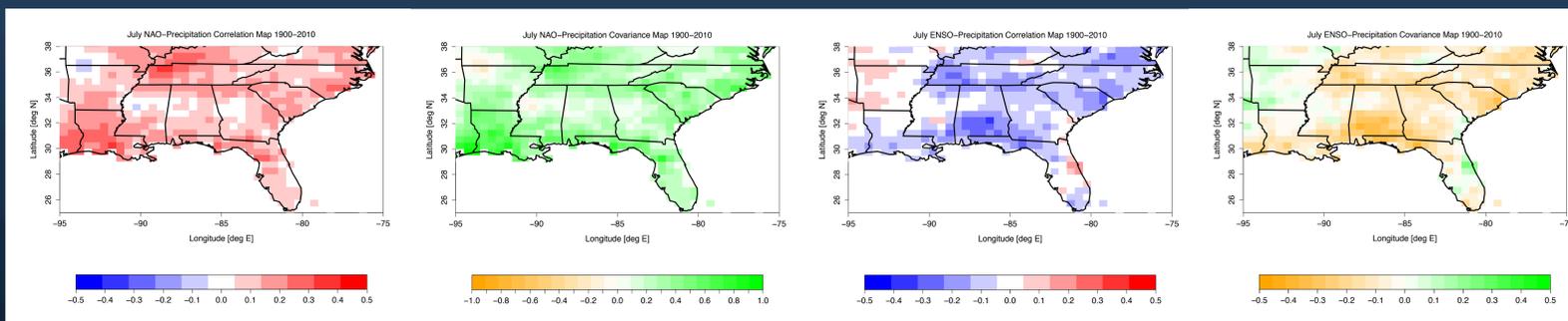


Figure 2. July tests revealed that NAO has a slight influence on precipitation rates for the month, whereas El-Niño has a weak relationship with July precipitation. July NAO-Precipitation correlation peaked at 0.48, with a covariance coefficient peaking at 0.85 for NAO. June was the month which had the strongest connection with NAO.

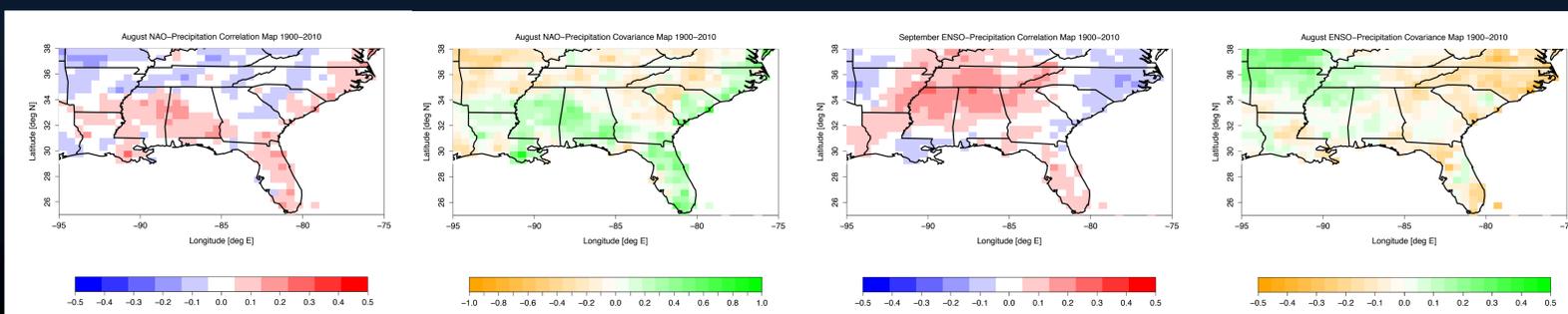
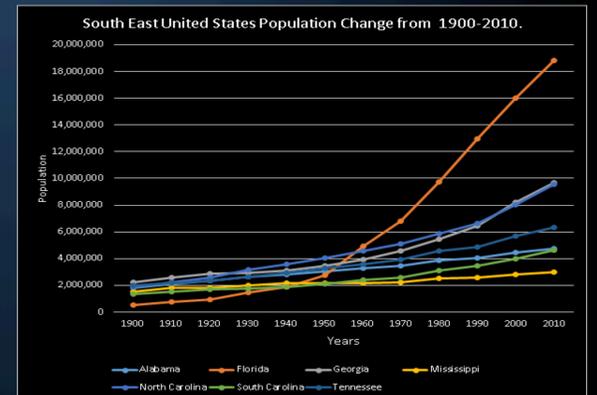


Figure 3. August tests revealed that neither NAO or ENSO have a strong sway over the regions expected precipitation. While covariance coefficients peaked around 0.76 for NAO, and 0.81 for ENSO, the correlation coefficients do not reveal any strength above a 0.38 for NAO and a 0.25 for ENSO.

## Conclusion & Discussion

- The results of this study provide evidence that neither NAO or ENSO are dominant factors which induce a drought season for the American South East, rather there are a multitude of processes which influence drought in the region.
- Future study should focus on analyzing demographics within the region to determine if drought is increasing due to increased anthropogenic activity rather natural variation.
- Due to the complicated nature of drought and what causes it, the results of this study provide evidence that drought is an extremely random process, which may require multiple processes to be analyzed in order to successfully forecast it.



## Acknowledgements

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